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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/844,855	04/26/2001	Song-Hua Shi	42390P10937	1410

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EXAMINER

COSTANZO, PATRICIA M

ART UNIT	PAPER NUMBER
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2811

#4

DATE MAILED: 06/24/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/844,855

Applicant(s)

SHI ET AL.

Examiner

Patricia M. Costanzo

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 - 26 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1 - 26 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 April 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The use of the trademark Siloxirane™ has been noted in this application. It should be capitalized wherever it appears and be accompanied by the generic terminology.¹

Although the use of trademarks is permissible in patent applications, the proprietary nature of the marks should be respected and every effort made to prevent their use in any manner that might adversely affect their validity as trademarks.

Claim Rejections - 35 USC § 112 2nd paragraph

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1, 2, 22, 25, and 26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1, 2, 22, 25, and 26 contain the trademark/trade name Siloxirane™. Where a trademark or trade name is used in a claim as a limitation to identify or describe a particular material or product, the claim does not comply with the requirements of 35 U.S.C. 112, second paragraph. See *Ex parte Simpson*, 218 USPQ 1020 (Bd. App. 1982). The claim scope is uncertain since

¹ Siloxirane as a trademark is not registered with the United States Patent and Trademark Office, but see the Siloxirane™ page as a link on the Advanced Polymer Sciences, Inc. Internet site.

the trademark or trade name cannot be used properly to identify any particular material or product. A trademark or trade name is used to identify a source of goods, and not the goods themselves. Thus, a trademark or trade name does not identify or describe the goods associated with the trademark or trade name. In the present case, the trademark/trade name is used to identify/describe a resin containing O-Si-O groups, along with a reactive organic functional group, and an aromatic group, whereas Applicant is reciting a resin containing O-Si-O groups, along with a reactive organic functional group, and an organic chain segment, and, accordingly, the identification/description is indefinite.

4. Claims 3 – 21, 23, and 24 are rejected as depending from a rejected claim.
5. Claim 4 is rejected because the phrase “R1 is a cyclic SiO₂ domain” is not clear. How can R1 be a “domain”? Additionally, the word “cylic” should be spelled “cyclic”.
6. Claim 7 is rejected because according to the wording of the claim, both R2 and R3 are represented by the chemical structure illustrated as part of the claim. This is confusing.
7. Claim 8 is rejected for reasons similar to that given for the rejection of Claim 7. Examiner does not believe that Applicant intends for R1, R2, and R3 all to be represented by the chemical structure illustrated as part of the claim.

Art Unit: 2811

Additionally, it appears that the carbon that is between the oxygen and the carbon of the oxirane group is missing a bond (i.e., carbon always has four bonds).

8. Claim 12 is rejected because Claim 12 recites the limitation "the agent". There is insufficient antecedent basis for this limitation in the claim. Although Claim 12 recites "the fluxing agent", the claim is confusing because one does not usually recite that a substance is dissolved in a mixture wherein the mixture consists of itself (i.e., the substance) and something else.
9. Claim 17 is rejected because it presents confusion as to the scope or clarity of the claim. Does Applicant mean that the surfactant recited in Claim 17 comprises a mixture of polyol, a siloxane compound, and a fluorinated compound, or does Applicant mean that the surfactant is selected from the group consisting of polyol, a siloxane compound, and a fluorinated compound (see MPEP 2173.05(h)).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

11. Claims 1 and 9 - 26 (as far as these claims are in compliance with 35 U.S.C. 112, 2nd paragraph) is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,180,696 (Wong *et al.*) in view of U.S. Patent No. 5,026,816 (Keehan).

Referring to Claim 1 (as well as an indefinite claim can be understood): Wong *et al.*

disclose a no-flow underfill material (see Abstract, first line) comprising:

an epoxy resin (see Abstract, first line);

at least one agent acting as a cross-linking hardener (Col. 5, lines 1 - 2) and a curing catalyst capable of catalyzing the curing of the epoxy resin (Col. 5, lines 13 - 22); and

a fluxing agent (Col. 5, 23 - 47).

Wong *et al.* do not disclose a Siloxirane™ epoxy resin.

Keehan discloses a Siloxirane™ epoxy resin (see, Col. 3, lines 53 - 56, in conjunction with Col. 4, lines 3 - 6 and 36 - 39).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the no-flow epoxy underfill material disclosed by

Art Unit: 2811

Wong *et al.* by providing for a Siloxirane™ epoxy resin as disclosed by Keehan to obtain multiple advantages. Siloxirane™ polymer systems have enhanced chemical and corrosion resistance, high adhesive strength, high heat deflection temperatures and toughness (Keehan, Col. 3, lines 17 – 19).

Referring to Claim 9 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.* and Keehan discloses no-flow underfill, as recited above, further disclosing wherein the agent acting as a cross-linking hardener and a catalyst includes both a hardener and a catalyst (see Wong *et al.*, Col. 5, lines 1 – 2 for a hardener and lines 13 – 22).

Referring to Claim 10 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.* and Keehan discloses no-flow underfill, as recited above, further disclosing wherein the agent acting as a cross-linking hardener is an anhydride (see Wong *et al.*, Col. 5, lines 1 – 5).

Referring to Claim 11 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.* and Keehan discloses no-flow underfill, as recited above, further disclosing wherein the catalyst is a imidazolium salt (see Wong *et al.*, Col. 5, line 21).

Referring to Claim 12 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.* and Keehan discloses no-flow underfill, as recited above, except does not explicitly disclose wherein the fluxing agent is dissolved in a

mixture of the resin and the agent (which Examiner will take as the agent recited in Claim 9 that is comprised of a hardener and a catalyst).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the material disclosed by Wong *et al.* and Keehan by providing for the fluxing agent to be dissolved in a mixture of the resin and the hardener and catalyst as a no-flow underfill process provides for reflow of the solder joint and curing of the underfill simultaneously, the fluxing agent would have to be an integral part of the mixture containing the resin to obtain the benefit of enabling the flux to accomplish what it is designed to accomplish, namely, to remove the metal oxide from the conductor pads and prevent the solder melt from re-oxidation.

Referring to Claim 13 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.* and Keehan discloses no-flow underfill, as recited above, further disclosing wherein the fluxing agent is glycerol – $C_3H_5(OH)_3$ – which has three hydroxyl (OH) groups (see Wong *et al.*, Col. 5, line 44).

Referring to Claims 14 and 15 (as well as indefinite claims can be understood): the proposed material of Wong *et al.* and Keehan discloses no-flow underfill, as recited above, further comprising a silane coupling agent as an adhesion promoter (see Wong *et al.*, Col. 6, lines 1 and 2).

Referring to Claim 16 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.* and Keehan discloses no-flow underfill, as recited above,

further comprising a non-ionic surfactant (see Wong *et al.*, Col. 6, lines 10 – 20 for a selection of non-ionic surfactants).

Referring to Claim 17 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.* and Keehan discloses no-flow underfill, as recited above, further disclosing wherein the surfactant is a polyol (see Wong *et al.*, Col. 6, line 17).

Referring to Claims 19 and 20 (as well as indefinite claims can be understood): the proposed material of Wong *et al.* and Keehan discloses no-flow underfill, as recited above, except for explicitly disclosing wherein the material further comprises silver flakes.

Wong *et al.* do, however, explicitly teach that “[t]he epoxy material may also include various additives known to those skilled in the art . . . to obtain . . . better thermal or electrical conductivity (see Wong *et al.*, Col. 14, lines 27 - 33).

It is well known to use silver flakes to provide electrical conductivity (as is admitted by Application [0021]). It is equally well known to use silver flakes to provide thermal conductivity

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the material disclosed by Wong *et al.* and Keehan by adding silver flakes to obtain the benefit of better electrical and thermal conductivity as it was well known to do so and as taught by Wong *et al.*

Art Unit: 2811

Referring to Claim 21 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.* and Keehan discloses no-flow underfill, as recited above, except for further explicitly disclosing wherein the thermally conductive particles are diamond.

As discussed above, however Wong *et al.* teach the use of additives to enhance thermal conductivity and it was well known by those of ordinary skill in the art that diamond is an excellent conductor of heat, therefore it would have been obvious to do so.

Referring to Claims 22, 23, and 24 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.* and Keehan discloses no-flow underfill, as recited above, including the limitations recited in Claim 22 noting that on page 6 of the present Application, Applicant states that the O-Si-O can be either fused silica or a cyclic group.

Referring to Claim 25 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.* and Keehan discloses no-flow underfill, as recited above, including the limitations recited in Claim 25 noting that on Wong *et al.* teach their epoxy resin for use as a no-flow underfill that is used in flip-chip technology during the simultaneously occurring processes of curing and reflowing that provide the means to attach a semiconductor die to a substrate. Examiner takes official notice that in flip-chip devices the die and the substrate have contact and

bond pads, respectively, wherein conductive bumps contact the pads; this is the standard means by which a "flipped" chip is electrically connected to a substrate.

Referring to Claim 26 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.* and Keehan discloses no-flow underfill, as recited above, including the limitations recited in Claim 26.

12. Claims 2, 3, 4, 5, 6, 7, and 8 (as far as Claims 2, 3, 4, 5, 6, 7, and 8 are in compliance with 35 U.S.C. 112, 2nd paragraph) are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,180,696 (Wong *et al.*) in view of U.S. Patent No. 5,026,816 (Keehan) and further in view of Japanese Patent No. 61112086 (Inokuchi *et al.*)

Referring to Claim 2 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.* and Keehan, discloses no-flow underfill, as recited above, further disclosing wherein the SiloxiraneTM resin is represented by



where:

R1 includes SiO₂ (see final compound of Keehan, displayed across Cols. 7 and 8);

R2 is a reactive organic functional group (see the oxirane group in the final compound); and

R3 is an organic chain segment (see the aliphatic moiety in the final compound).

Alternatively, Inokuchi *et al.* disclose a Siloxirane™ resin represented by



where R1 – R3 – R2 have the same meaning as above (see the cyclic oxirane attached to the short chain which is attached to the Si containing group, Figure 1, page 1022, Japanese Patent).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the proposed material as disclosed by Wong *et al.* and Keehan by providing for a Siloxirane™ resin represented by



where R1 – R3 – R2 have the same meaning as above, as proposed by Inokuchi *et al.* to obtain the benefit of providing for the compound to be free of the strong UV chromophores that are present in an aromatic ring epoxy resin, as taught by Wong *et al.*, Col. 4, lines 46 - 49.

Referring to Claims 3 and 18 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.*, Keehan, and Inokuchi *et al.*, discloses no-flow underfill, as recited above, except for explicitly disclosing wherein R1 is a surface-grafted fused silica particle with a size less than 50 microns.

Wong *et al.*, do, however, explicitly disclose the use of amorphous fumed silica, such as CAB-O-SIL TS-720 that has an average particle length of 0.2-0.3

Art Unit: 2811

microns (note that the other dimensions would be less (see Cabot Corporation data sheet, enclosed).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the proposed material of Wong *et al.*, Keehan, and Inokuchi *et al.* by using fumed silica as a source of SiO₂ as both of these products are formulations of SiO₂ and fumed silica has the advantage of being less costly.

Referring to Claim 4 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.*, Keehan, and Inokuchi *et al.*, discloses no-flow underfill, as recited above, further disclosing wherein R1 is a cyclic SiO₂ (see Keehan, final product illustrated across Cols. 7 and 8).

Referring to Claim 5 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.*, Keehan, and Inokuchi *et al.*, discloses no-flow underfill, as recited above, further disclosing wherein R1 includes an oxygen atom linked to the silica particle, R3 being linked to the oxygen atom (see Keehan, final product illustrated across Cols. 7 and 8 where a silicon ion from the silica particle is linked to an oxygen which is linked to an R3 group (i.e., an organic chain segment).

Referring to Claim 6 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.*, Keehan, and Inokuchi *et al.*, discloses no-flow underfill, as recited above, further disclosing wherein R2 includes the oxirane group (see

Art Unit: 2811

Keehan, final product illustrated across Cols. 7 and 8, or alternatively see Inokuchi *et al.*, Figures 1 or 2, page 1022 of Japanese Patent).

Referring to Claim 7 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.*, Keehan, and Inokuchi *et al.*, discloses no-flow underfill, as recited above, further disclosing wherein R2 is and oxirane group wherein R3 and R' are attached to one of its two carbons and R'' and R''' are attached to the other carbon and where R', R'', and R''' are hydrogen or alkyl groups (see Inokuchi *et al.*, Figure 2, page 1022 of Japanese Patent).

Referring to Claim 8 (as well as an indefinite claim can be understood): the proposed material of Wong *et al.*, Keehan, and Inokuchi *et al.*, discloses no-flow underfill, as recited above, further disclosing wherein R1 is attached to R3 which is attached to R2, and wherein R2 is one of the oxirane groups illustrated in Claim 8 groups (see Inokuchi *et al.*, Figure 2, page 1022 of Japanese Patent).

Art Unit: 2811

Conclusion

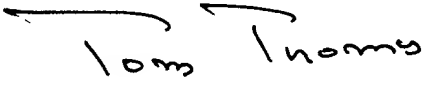
Any inquiry concerning this communication should be directed to Patricia Costanzo at 703 305-5675 on Monday – Friday from 8:00 A.M. – 5:00 P.M.

If attempts to reach the examiner by telephone are unsuccessful Supervisory Primary Examiner Tom Thomas can be reached at 703 308 -2772.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group Receptionist at 703 308-0956.

Using facsimile machines to transmit correspondence is encouraged. The official Technical Center 2800 before-final FAX number is 703-872-9318 and the after-final FAX number is 703-872-9319. These FAX numbers will provide the FAX sender with an auto-reply verifying receipt of their FAX by the United States Patent and Trademark Office. If there should be a problem while faxing to the Office, please contact Technical Center 2800 Customer Service at 703-306-3329.

pmc
June 19, 2002


TOM THOMAS
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